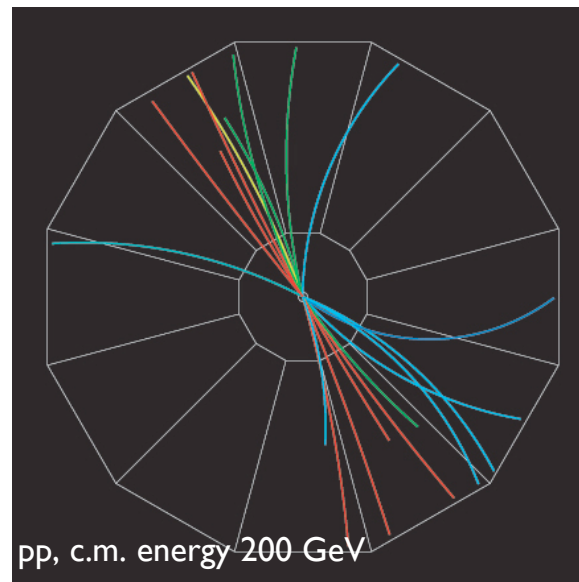




SPIN: Progress and near-term Prospects

Ernst Sichtermann (LBL) *for the STAR Collaboration*



- Motivation
- STAR near term goals
- Detector Status
- Ongoing run
- Analysis: Status and Prospects
- Concluding Remarks

Nucleon Spin - Motivation

Surprises,

- Quark Spins contribute little to the Proton's Spin
- Lambda Polarization
- ...

Unknowns,

- Gluon helicity ??,
- Quark helicity by flavor ?,
- Transversity ???,
- Spin effects in fragmentation ???,
- Orbital momenta ???,
- ...



2005 Beam Use Request - Longitudinal Polarizations

STAR proposes to give high priority to:

- a *robust* measurement of ΔG ,

a study which has been of *world-wide interest* for several decades, and which has the potential to elucidate the parton dynamics within the proton.

Specifically, STAR's goal is to:

- sample $> 7 \text{ pb}^{-1}$ with $P > 40\%$ $\sqrt{s} = 200 \text{ GeV}$

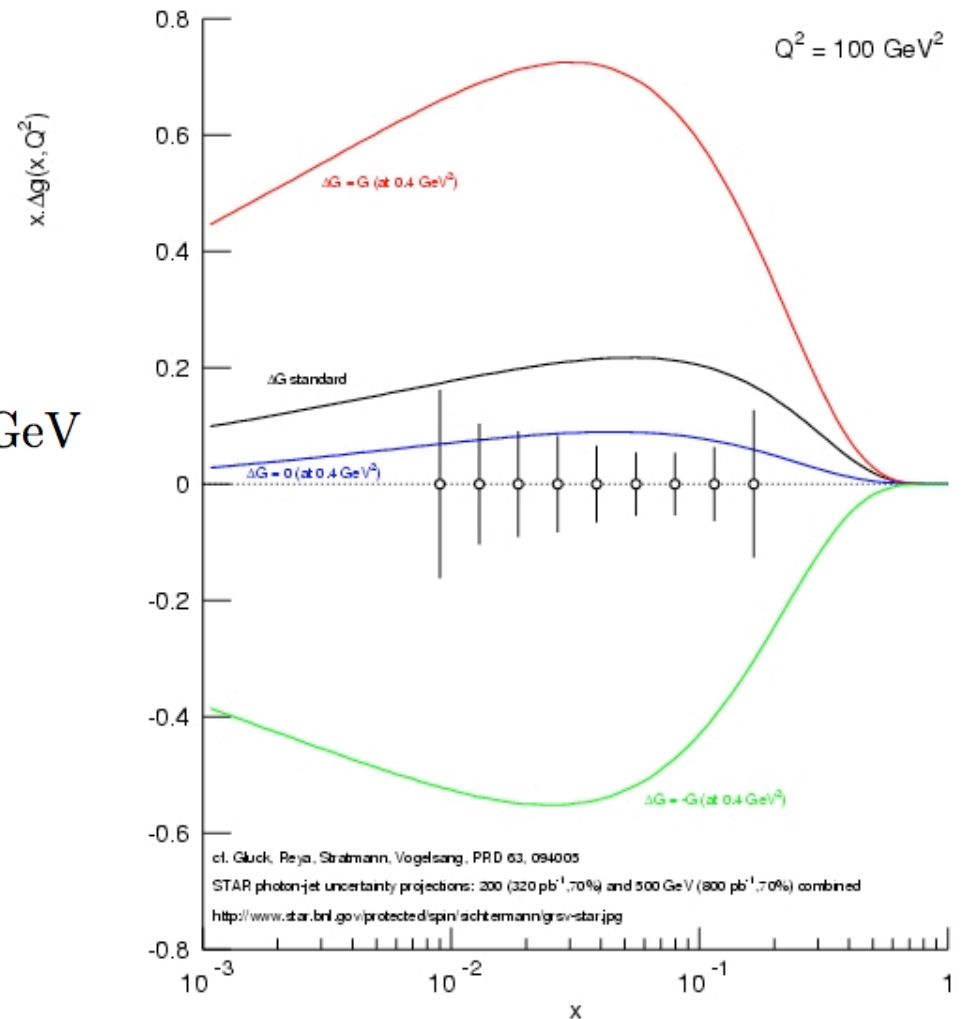
with beams of longitudinally polarized protons to obtain a *significant measurement* of the gluon helicity preference in the proton through studies of:

- $A_{LL}(\text{jets})$ out to $p_T > 20 \text{ GeV}/c$
- $A_{LL}(\pi^0)$ out to $p_T > 8 \text{ GeV}/c$

These are *beginning measurements* which will be followed by a study of:

- $\Delta G(x_{\text{gluon}})$ using $\vec{p}\vec{p} \rightarrow \gamma + \text{jet}$

once further improvements in luminosity and polarization have been achieved.



Final prompt photon goal, *not* 2005 BUR



2005 Beam Use Request - Transverse Polarizations

Although the STAR spin program is still in its infancy, the first polarized proton runs have already yielded *new* results. Specifically,

- forward π^0 production at large x_F and moderate p_T

suggest a strong sensitivity to aspects of the parton distributions tied to the transverse spin orientation of a proton.

Once the goals with longitudinally polarized proton beams have been substantially met, STAR proposes to:

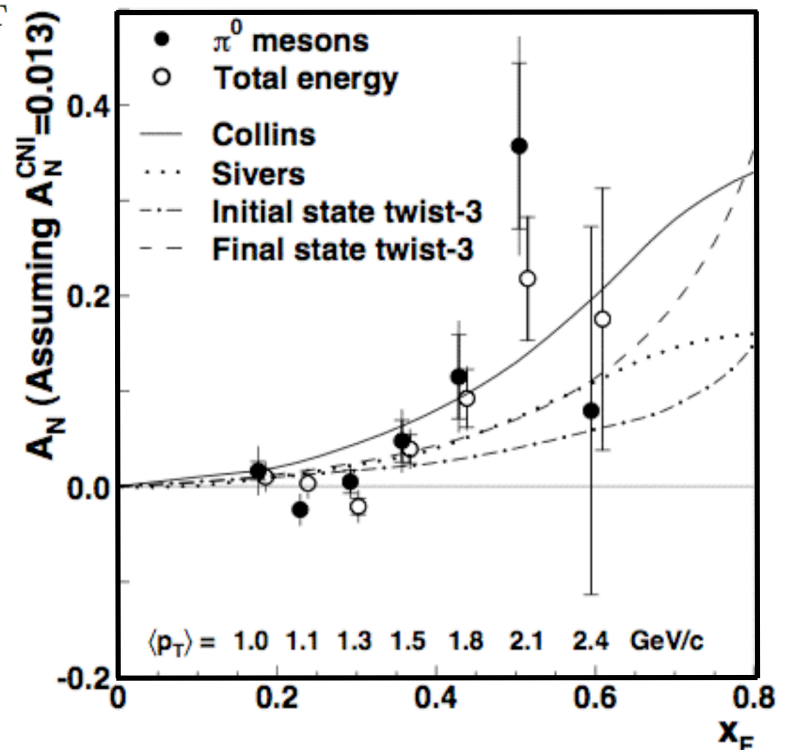
- sample $> 4 \text{ pb}^{-1}$ with transverse $P > 40\%$

to measure:

- the transverse spin dependence of dijet back-to-back correlations as a function of the opening angle between the jet axes, and
- the separated x_F and p_T dependencies of the forward neutral pion production asymmetry.

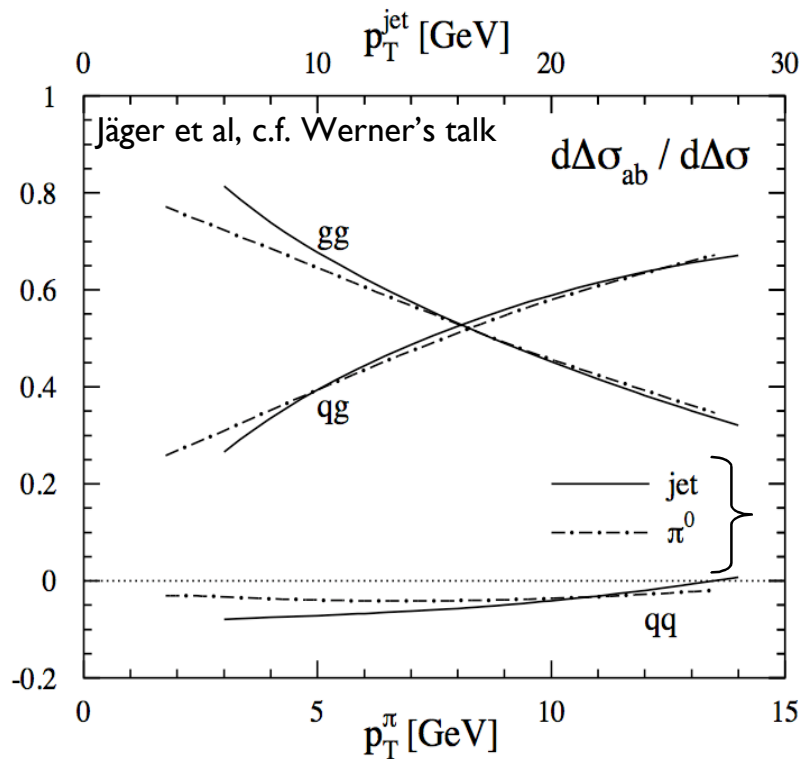
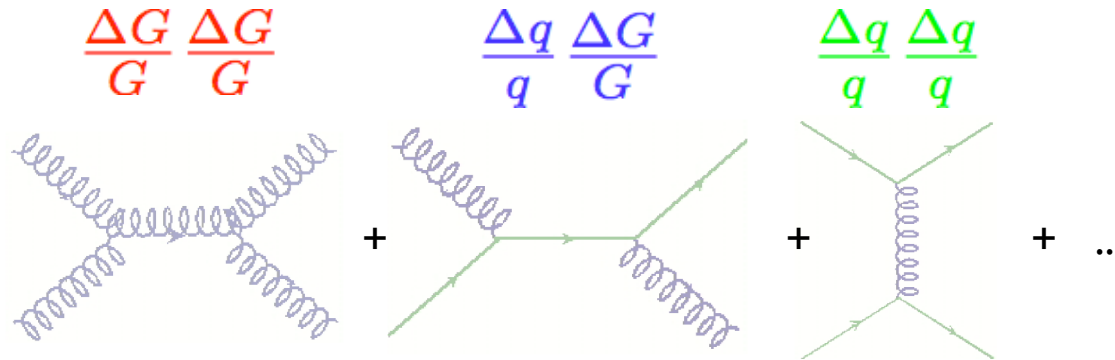


J. Adams et al, PRL 92: 171801 (2004)

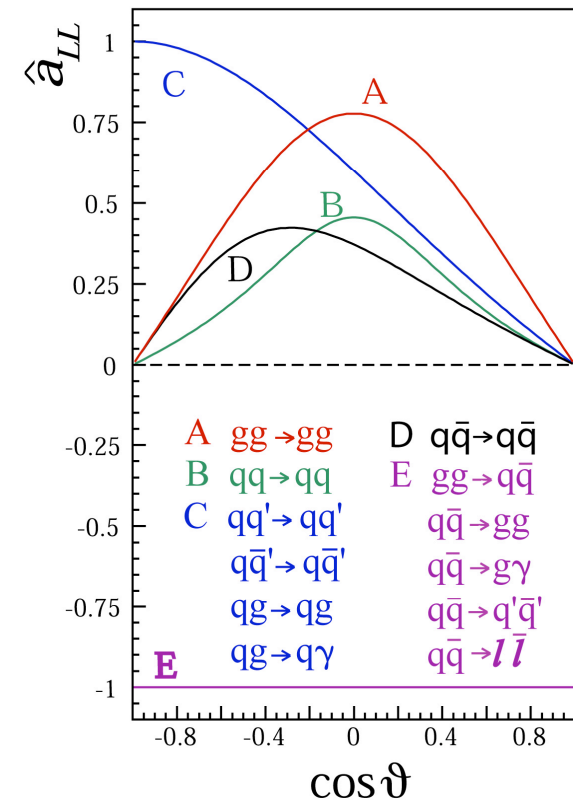


Longitudinal Spins and Inclusive Jets (neutral pions)

Sensitivity to:



Similar



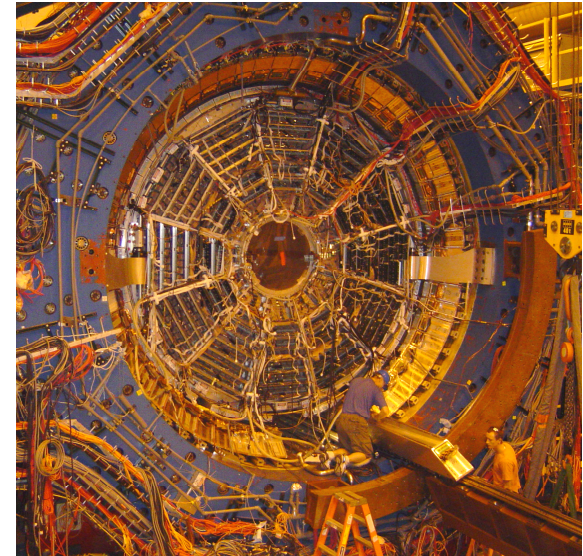
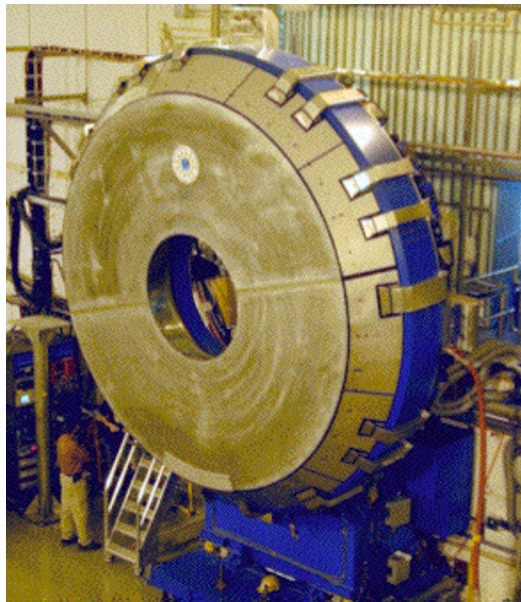
Sizable partonic asymmetries at 'midrapidity'.



Status of Ongoing Upgrades for SPIN

Lead-Scintillator Barrel EM Calorimeter,

- all $4800 \Delta\eta \times \Delta\phi = 0.05 \times 0.05$ towers installed,
- west-half fully instrumented (used in trigger),
- east-side half-instrumented (towers only, not used in trigger).



Lead-Scintillator Endcap EM Calorimeter,

- Complete for 2005!
- $1 < \eta < 2$



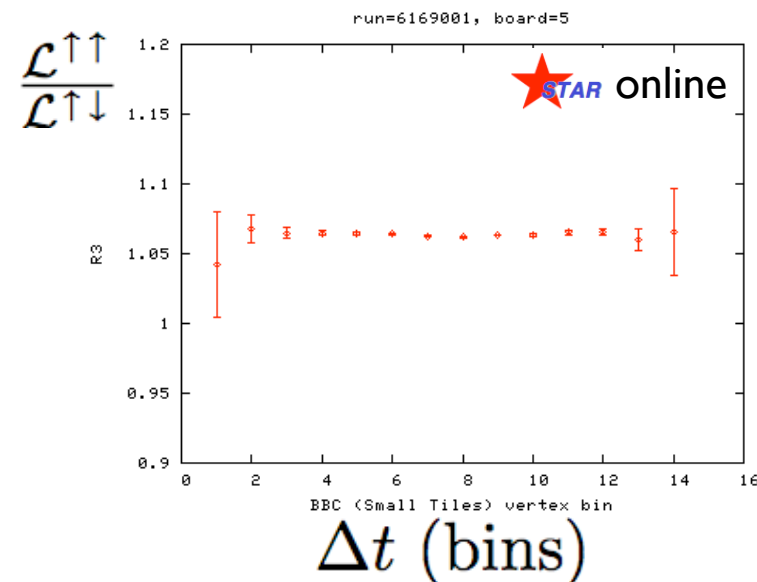
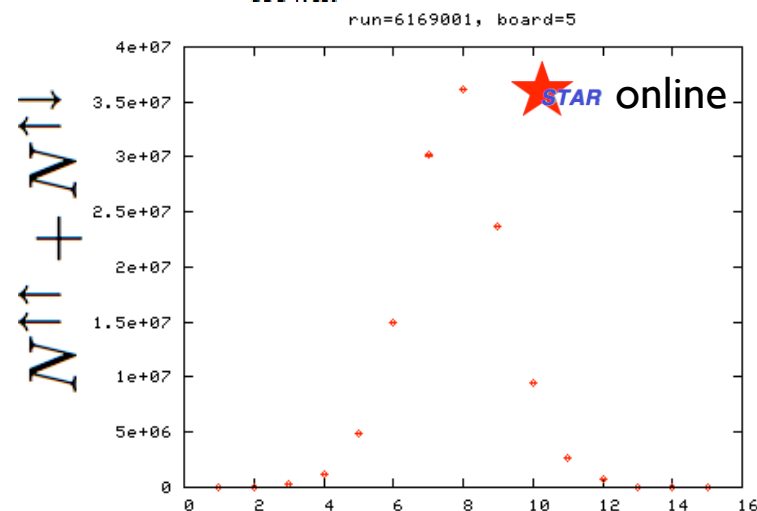
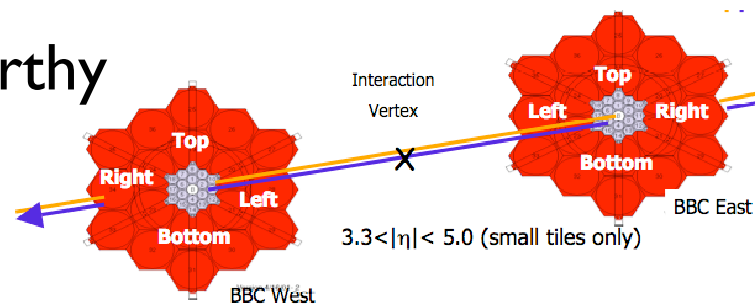
New and Noteworthy

The STAR Scaler System, used together with the STAR Beam-Beam Counters, for

- Local Polarimetry,
- Relative Luminosity Measurements,

has been modified to measure in addition:

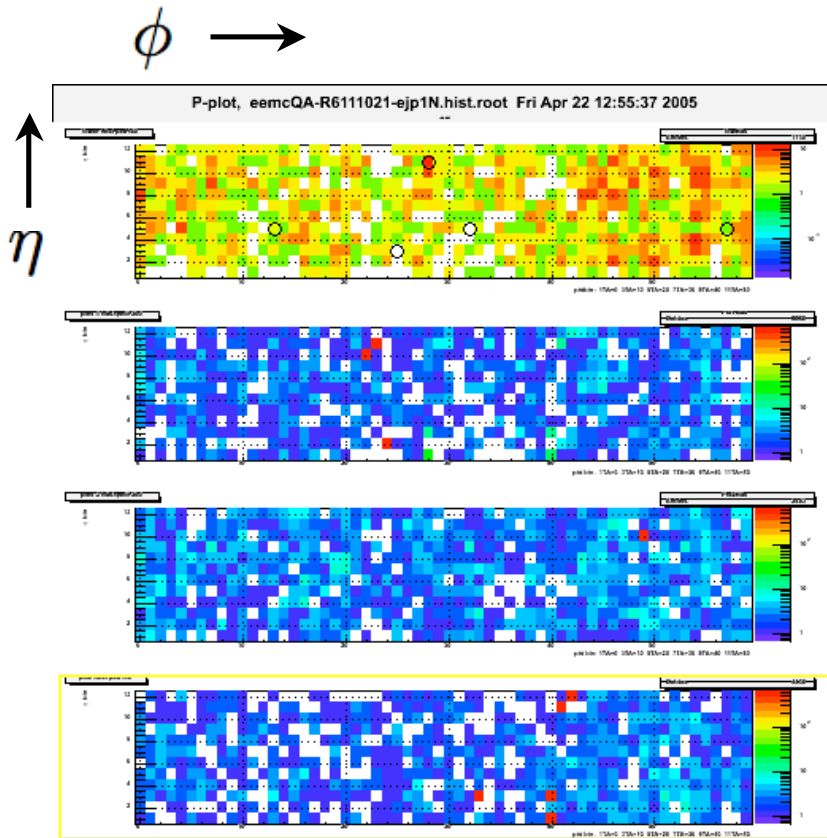
- Relative Luminosity vs. Vertex,
- Livetime for different spin orientations,
- Calorimeter coincidences



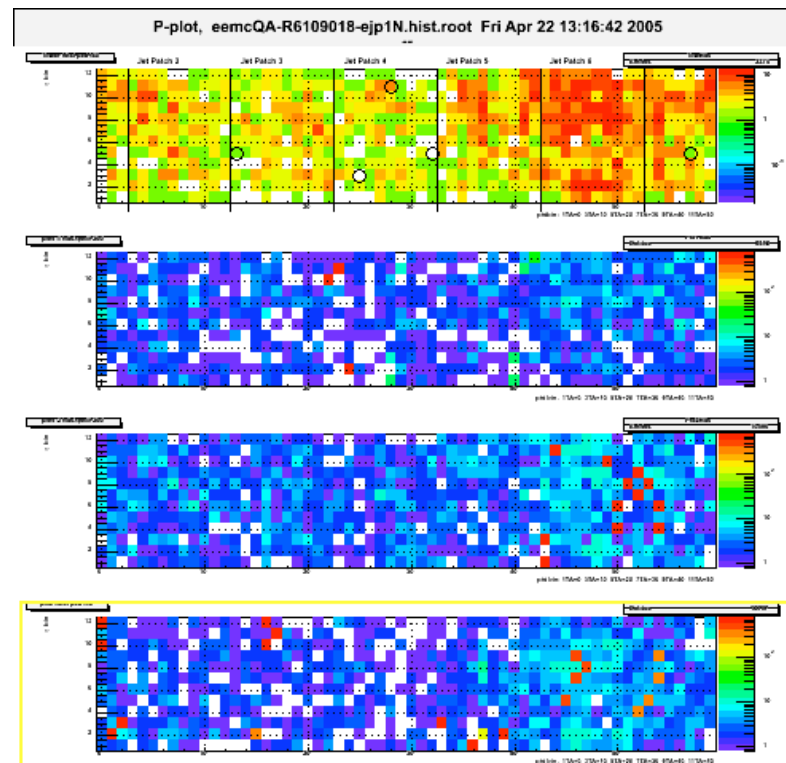


New and Noteworthy

Endcap Calorimeter Instrumental in Characterization of Beam Conditions,



Background 'OK'



Background 'HIGH'

Towers

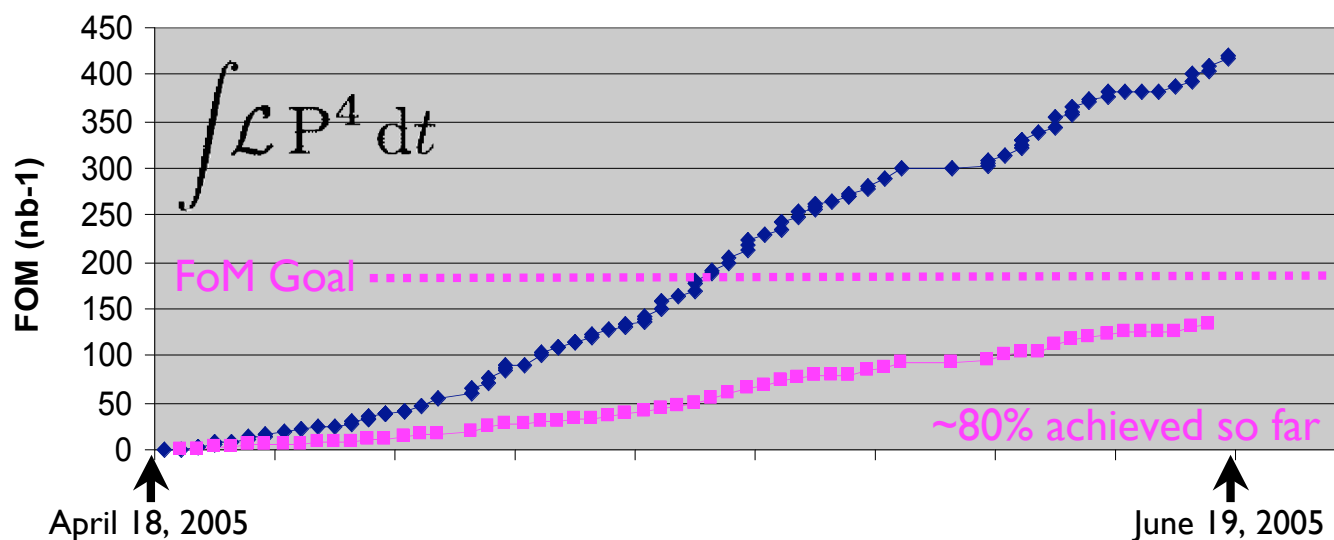
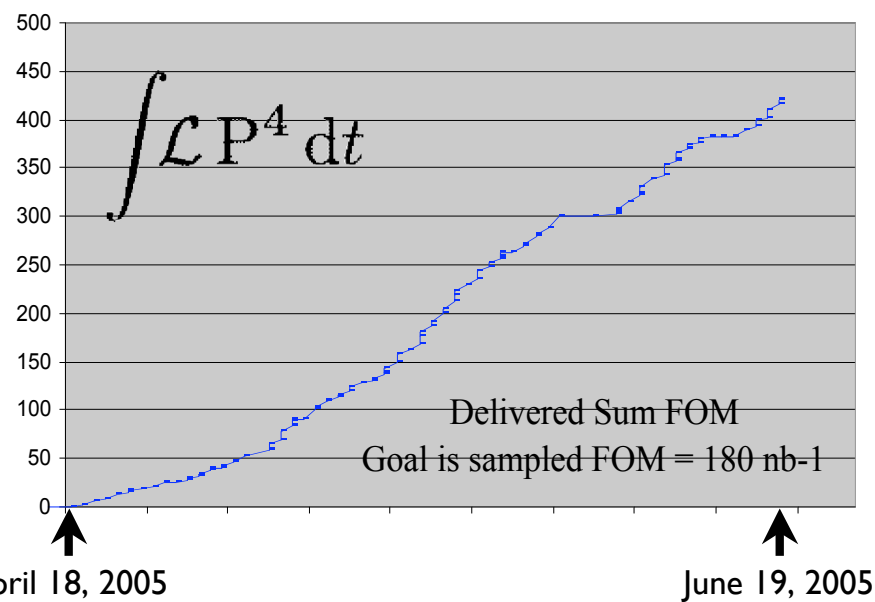
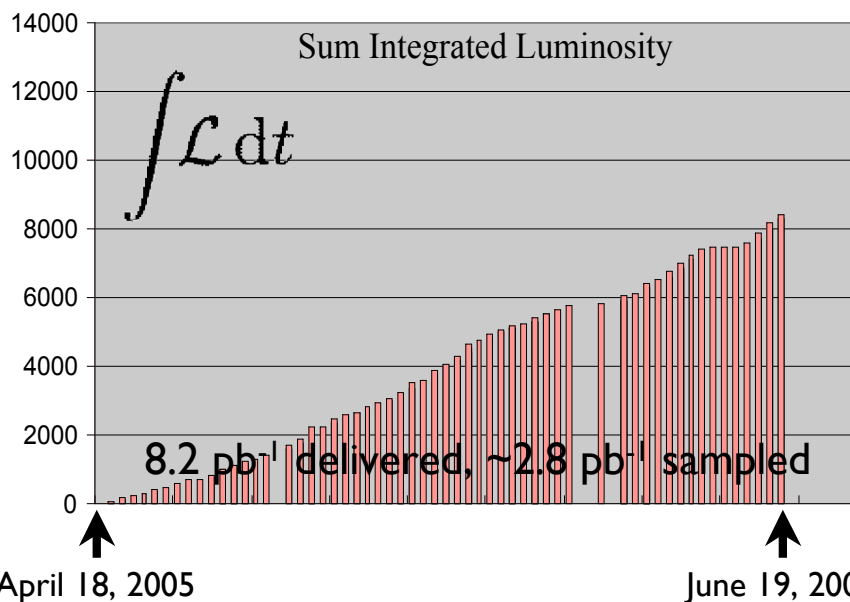
Pres. 1

Pres. 2

Post-s

Complementary to (other) online-measures from the Beam-Beam Counters.

2005 Data Collection - Longitudinal Goal 7pb⁻¹, 40% sampled



+ 2 fills $\sqrt{s} = 410$ GeV

+ 60 hrs transverse



Analysis: neutral pions

Readying Algorithms to reconstruct neutral pions in the barrel and endcap regions using Monte Carlo and the 2004 data sample.

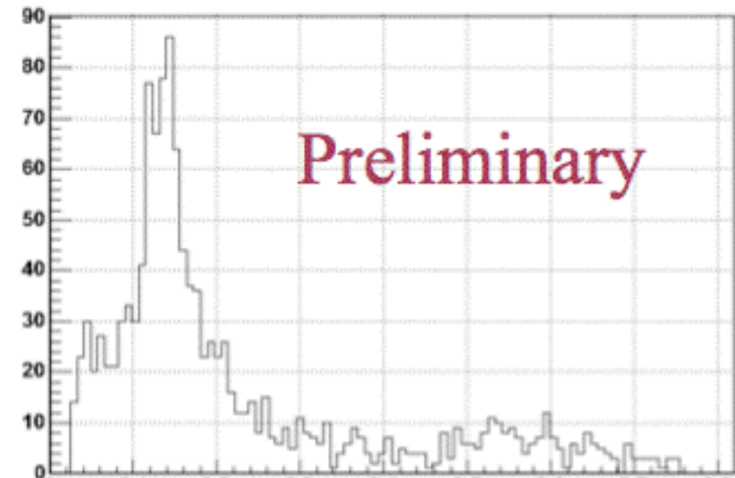
Goals:

- neutral pions from 2005, and
- ultimately prompt photons.

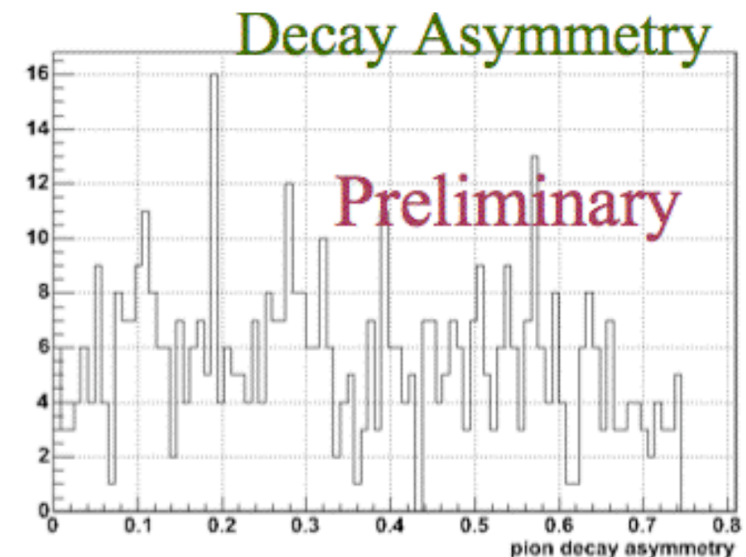
On the right, output from endcap pion reconstruction using:

clusters in the SMD U/V planes,
tower energies at U/V crossings,
the decay asymmetry

Monte Carlo 'data':



Monte Carlo 'data':

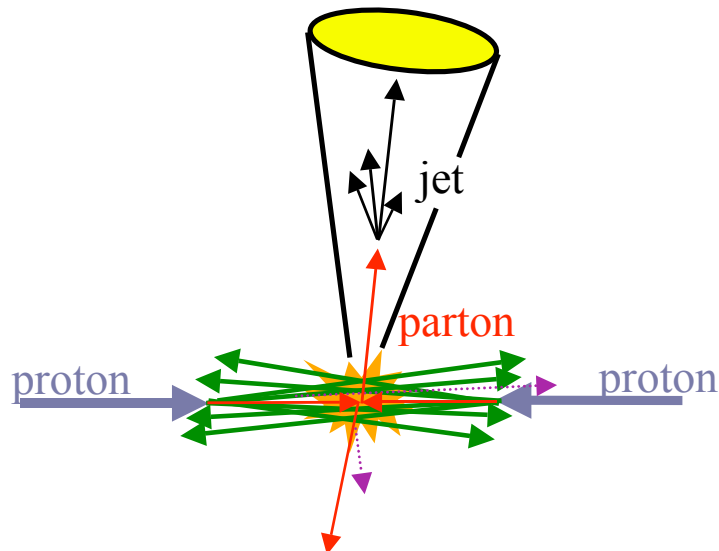




Analysis: Jet Finding and Reconstruction

STAR reconstructs jets via TPC p_T for charged hadrons and (B)EMC E_T for em-showers,

c.f. Blazey et al, hep-ex/0005012 (Tevatron run-II)



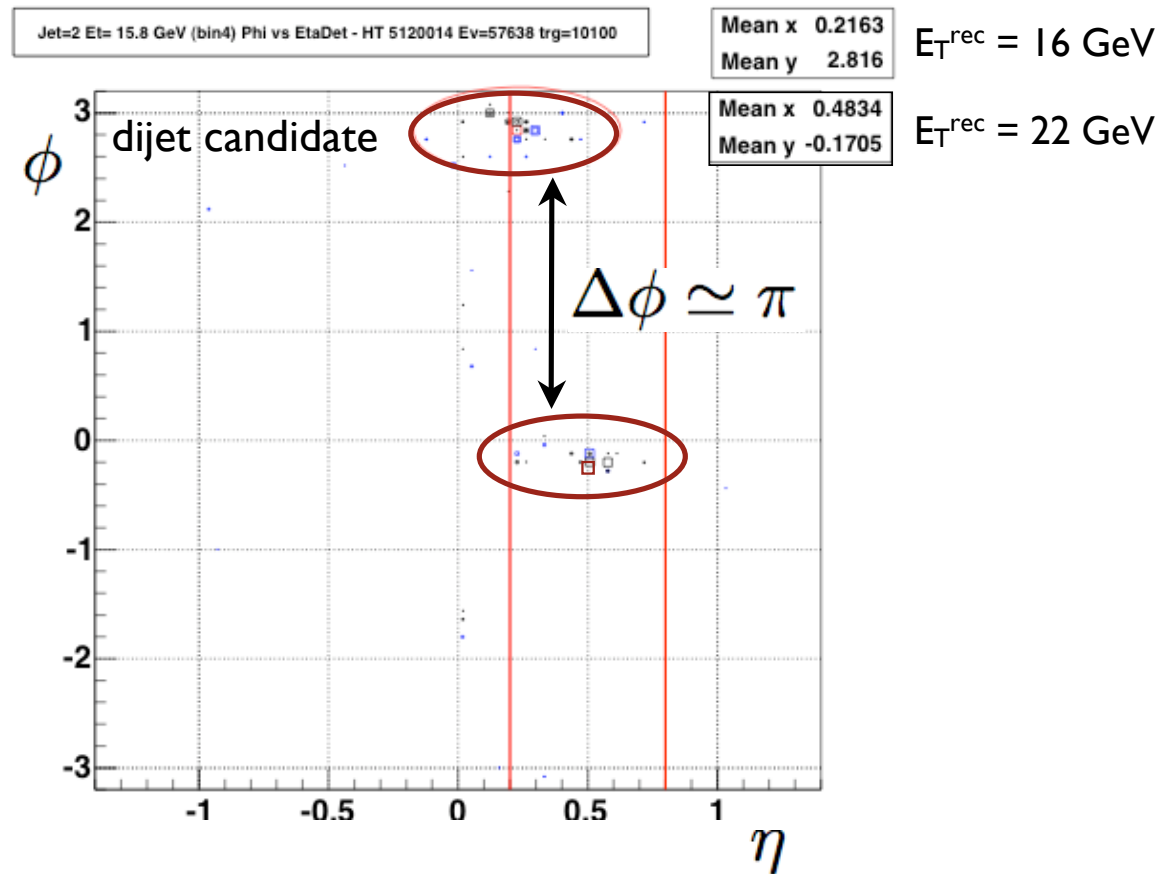
TPC

track $p_T > 0.2 \text{ GeV}/c$
track $|\eta| \leq 1.6$

BEMC tower $E_T > 0.1 \text{ GeV}$

Jet

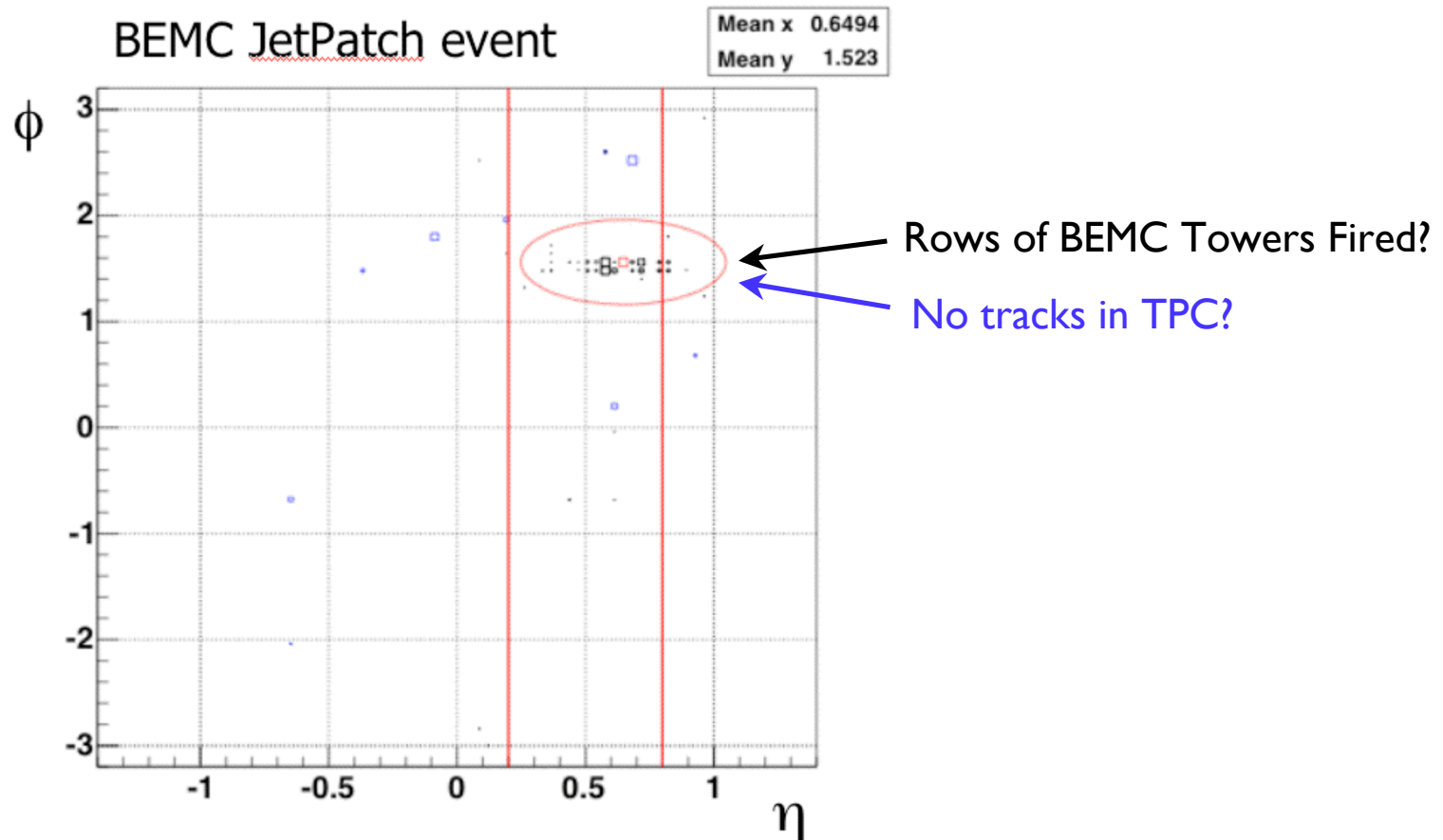
$p_T > 5 \text{ GeV}/c$
 $0.2 < |\eta^{\text{det}}| < 0.8$
 $R = 0.4$





Analysis: Jet Finding and Reconstruction

Background,

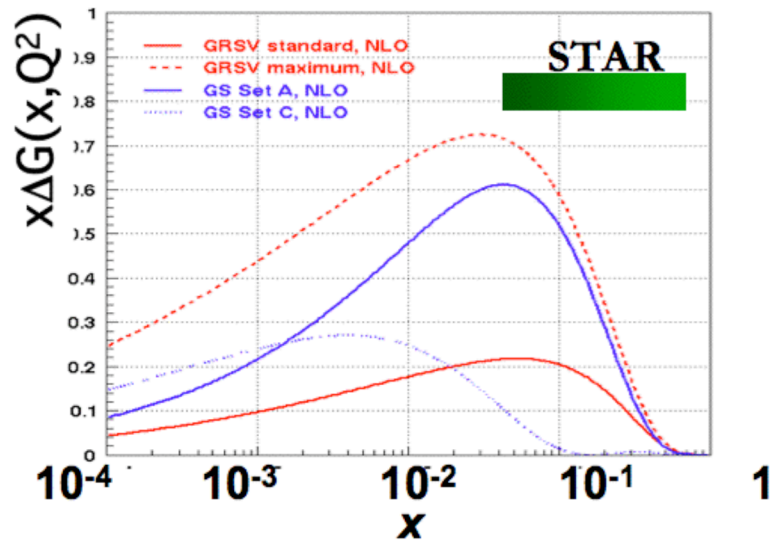


comes with *considerable* analysis 'cost'

Weed it out at its roots where feasible!

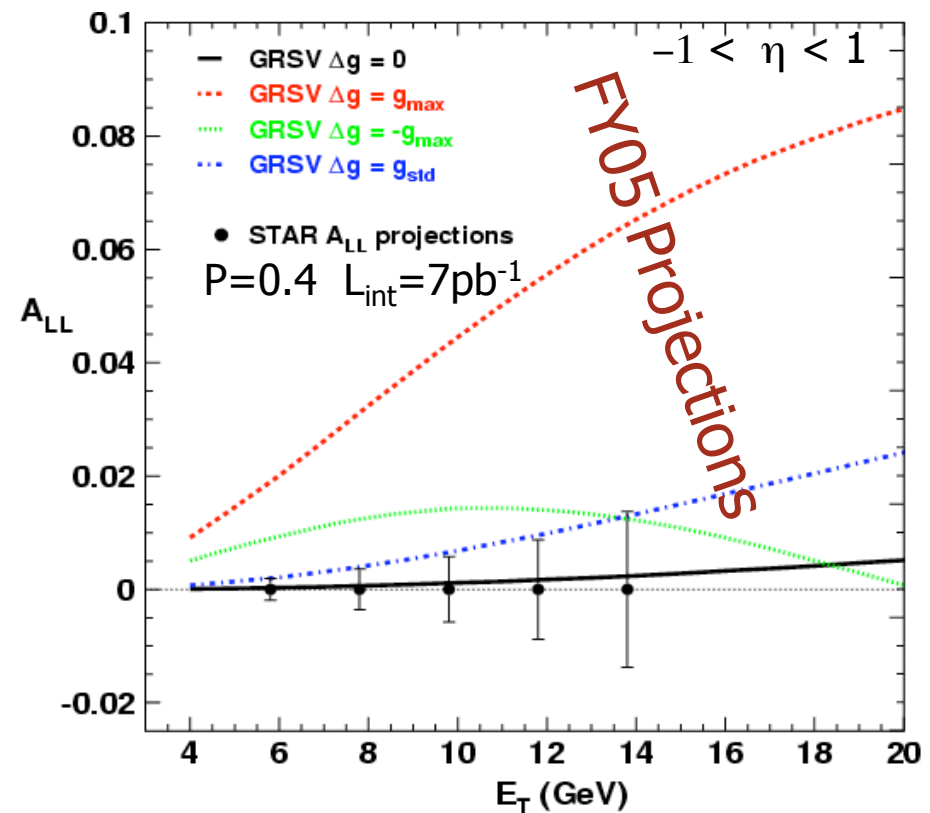


Inclusive Jets: Near Term Prospects



Kinematic Coverage, although still limited, where ΔG is sizable

Potential to *discriminate* between several of the expectations based on DIS parametrizations (not all of which are equally probable).



Concluding Remarks

Ongoing 2005 run:

- is going well in terms of longitudinal goals; higher than anticipated polarizations compensate the lower luminosities,
- will severely undershoot the transverse goals.

Analyses are gearing up for

- inclusive jet asymmetries,
- inclusive π^0 asymmetries over a wide range in η

both at a level of precision where they start to have the potential to discriminate between gluon polarization parametrizations based on DIS data.

I am hopeful that STAR will have

- a preliminary jet result from 2003/4 late summer,
- a preliminary result on polarization transfer in Λ production